REMARKS

Claim 12 has been added in order to more particularly point out, and distinctly claim the subject matter to which the applicants regard as their invention. The applicants respectfully submit that new matter has been added. It is believed that this Amendment is fully responsive to the Office Action dated February 17, 2004.

Claims 1 - 12 remain in this application.

With respect to the Examiner's comments on the title of the invention, the applicants have amended the title of the invention in order to read as follows: "SEMICONDUCTOR DEVICE HAVING ACTIVE GROOVES."

The applicants respectfully request that the amended title of the invention be approved and entered by the Examiner.

The Examiner objects to the drawings for the reasons that the subject matters set forth in claims 6 - 9 are not contained in the drawings. The applicants respectfully request reconsideration of this objection.

First, the applicants respectfully submit that support for the claimed collector layer, as recited in claim 9, is found in the discussion of the collector layer 11' in lines 7 - 24, page 39 of the applicants' specification. Also, the collector layer 11' is shown in the applicants' Figures 35(a) and 35(b).

Secondly, as to the claimed inversion layer, as recited in claim 6, such claimed element is specifically discussed in line 13, page 36 through line 2, page 37 of the applicants' specification. The height of the semiconductor filler, as described in claim 7, is generally noted in lines 3 - 7, page 9 of the applicants' specification.

The applicants respectfully submit that because the inversion layer appears only when the voltage is applied to the transistor obtained by the present invention. The drawings shows steps of manufacturing transistor and the transistor thus obtained without applying voltage. Therefore, it is not possible to show the inversion layer in the drawing because the inversion layer is does not exist when the voltage is not applied.

Moreover, the inversion layer is only electrically formed, but not physically formed. It is not possible to show the inversion layer because it is not a physical layer.

Furthermore, the applicants respectfully submit certain portions of two of their Letters Patent. In, for example, line 7 to 15, column 8 of their U.S. Patent No. 6,573,559, there is a description of an inversion layer. Also, there is a description of an inversion layer in line 44 to 52, column 15 of their U.S. Patent No. 6,635,926. See, attached copies of certain pages of such Letters Patent. Here, there is similarly no illustration in the drawings of the inversion layer.

Accordingly, the applicants respectfully request reconsideration of the Examiner's objection to the drawings in relation to the inversion layer, and that such drawing objection be withdrawn.

Thirdly, with respect to the height of the semiconductor filler recited in claim 7, the height of the remaining portions of the semiconductor fillers 25 filled in the active grooves 22_1-22_3 and height of the semiconductor filler 26 filled in the inner circumferential groove 30 are shown in the applicants' Figures 13a and 13b to Figures 26a and 26b.

Lastly, with respect to the drain layer set forth in claim 8, in a discrete type MOS transistor, the conductivity type of substrate 11 and that of low concentration layer are the same; and the concentration of the substrate 11 is higher than that of low concentration layer 12 in order to form ohmic junction with the drain electrode.

Therefore, in the applicants' present invention, the drain layer is represented in the drawings as a substrate 11 because the substrate 11 functions as a drain layer in the general MOS transistor. If the substrate 11 is removed by polishing, a high concentration layer must be formed on the back surface of the substrate in order to form ohmic junction with the drain electrode. In such a case, the high concentration layer functions as a drain layer. Thus, it is not possible to replace the term "drain layer" with "substrate".

Furthermore, when the MOS transistor of the applicants' present invention included in IC, the substrate is a conductivity type opposed to that of the low concentration layer; and the high concentration layer partially diffused on the surface of the substrate functions as a drain layer.

Since the term "drain layer" is used as a pair of "gate and source" for an MOS transistor, the applicants' present invention refers a layer to form ohmic junction with a drain electrode as a "drain layer." Therefore, if a "substrate" is described in the description of the manufacturing steps in the applicants' specification, it is referred "drain layer" when the MOS transistor is used. Based on the above, the applicants takes the position that the drain layer is shown in the applicants' drawings.

In view of the above, the withdrawal of the outstanding drawing objection is in order, and is therefore respectfully solicited.

As to the merits of this case, the applicants thank the Examiner for now indicating that claim 11 would be allowable if amended in the manner suggested in item 6, pages 7 and 8 of the outstanding Action.

In light of the Examiner's suggestion, the applicants have added claim 12, which incorporates therein allowable claim 11. It is respectfully submitted that added claim 12 is now therefore also allowable.

Claim 8 is rejected under 35 U.S.C. §112, first paragraph, because the Examiner is of the opinion that the applicants' specification does not disclose the claimed semiconductor substrate having a drain layer as recited in claim 8. The applicants respectfully request reconsideration of this rejection.

In response, the applicants respectfully submit that the subject matter set forth in claim 8 is found in, for example, lines 8 - 13, page 9 of the applicants' specification.

Accordingly, the withdrawal of the outstanding rejection under 35 U.S.C. §112, first paragraph, is in order, and is therefore respectfully solicited.

Further to the merits of this case, the following rejections are set forth in the outstanding Action:

(1) claims 1 - 4, 6 and 8 are rejected under 35 U.S.C. §102(a) as being anticipated by "Applicant's prior art (APA);" and

(2) claims 5, 7, 9 and 10 are rejected under 35 U.S.C. §103(a) as being unpatentable based on the APA.

The applicants respectfully request reconsideration of these rejections.

As discussed in, for example, lines 3 - 10, page 26 of the applicants' specification with respect to the APA, the low concentration layer 112 "serves as a partition between both ends of the active groove[s 122] and the ring-shaped groove [130]," as also illustrated in the applicants' Figure 37. This results in the condition of epitaxial growth being different on both ends of the active groove from that in the central portion. As further specifically suggested in lines 7 - 10, page 26 of the applicants' specification: "[t]he speed of the epitaxial growth is actually slow on both ends of the active groove, resulting in both ends of the active groove incompletely filled with a semiconductor filler."

On the other hand, in the applicants' specification, in order to avoid the partitioning by a low concentration layer 12 of both ends of the active grooves 22 and the inner circumferential groove 30, such active grooves 22 and such inner circumferential groove 30 are connected. Such structural arrangement is clearly illustrated in, e.g., the applicants' Figures 1 and 4.

Moreover, the above-noted structural arrangement is specifically recited in independent claim 1. Such distinguishable structural arrangement, as set forth in claim 1, is not disclosed in the APA.

Accordingly, since not all of the claimed elements or features, as recited in claim 1, are found in exactly the same situation and united in the same way to perform the identical function in the APA, there can be no anticipation of the applicants' claimed invention under 35 U.S.C. §102(a) based on the APA. Furthermore, claims 2 - 4, 6 and 8 depend on claim 1, and further limit the scope of claim 1. Thus, at least for the reasons set forth above with respect to claim 1, dependent claims 2 - 4, 6 and 8 should now be similarly allowable.

In view of the above, the withdrawal of the outstanding anticipation rejection under 35 U.S.C. §102(a) based on the "Applicant's prior art (APA)" is in order, and is therefore respectfully solicited.

As to the outstanding obviousness rejection of claims 5, 7, 9 and 10 under 35 U.S.C. §103(a), the applicants respectfully submit that their above comments with respect to independent claim 1 are similarly applicable here. As such, in view of the above-discussed distinguishable structural arrangement, set forth in independent claim 1 from which claims 5, 7, 9 and 10 depend, the applicants' claimed invention would not have been obvious to a person of ordinary skill in the art under 35 U.S.C. §103(a) based on the teachings of the APA.

Accordingly, the withdrawal of the outstanding obviousness rejection under 35 U.S.C. §103(a) based on the APA is in order, and is therefore respectfully solicited.

In view of the aforementioned amendments and accompanying remarks, claims, as amended, are in condition for allowance, which action, at an early date, is requested.

If, for any reason, it is felt that this application is not now in condition for allowance, the Examiner is requested to contact the applicants' undersigned attorney at the telephone number indicated below to arrange for an interview to expedite the disposition of this case.

In the event that this paper is not timely filed, the applicants respectfully petition for an appropriate extension of time. Please charge any fees for such an extension of time and any other fees which may be due with respect to this paper to Deposit Account No. 01-2340.

Respectfully submitted,

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MRQ/lrj/ipc

Enclosures: (1) Portions of U.S. Patent No. 6,573,559 (cover page & col. 8)
(2) Portions of U.S. Patent No. 6,635,926 (cover page & col. 15)

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